From the Medical Board of the National Psoriasis Foundation: Treatment targets for plaque psoriasis

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Background: An urgent need exists in the United States to establish treatment goals in psoriasis.

Objective: We aim to establish defined treatment targets toward which clinicians and patients with psoriasis can strive to inform treatment decisions, reduce disease burden, and improve outcomes in practice.

Methods: The National Psoriasis Foundation conducted a consensus-building study among psoriasis experts using the Delphi method. The process consisted of: (1) literature review, (2) pre-Delphi question selection and input from general dermatologists and patients, and (3) 4 Delphi rounds.

Results: A total of 25 psoriasis experts participated in the Delphi process. The most preferred instrument was body surface area (BSA). The most preferred time for evaluating patient response after starting new therapies was at 3 months. The acceptable response at 3 months postinitiation was either BSA 3% or less or BSA improvement 75% or more from baseline. The target response at 3 months postinitiation was BSA 1% or less. During the maintenance period, evaluation every 6 months was most preferred. The target response at every 6 months maintenance evaluation is BSA 1% or less.

Limitations: Although BSA is feasible in practice, it does not encompass health-related quality of life, costs, and risks of side effects.

Conclusion: With defined treatment targets, clinicians and patients can regularly evaluate treatment responses and perform benefit-risk assessments of therapeutic options individualized to the patient. (J Am Acad Dermatol 2017;76:290-8.)

Key words: biologics; body surface area; outcome measures; Physician Global Assessment; psoriasis; systemic therapies; treat to target; treatment; treatment goals.

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Psoriasis is a chronic, inflammatory disease that affects 3.2% of the adult US population or nearly 8 million Americans.[1] Without appropriate treatment, patients with psoriasis experience substantial disease burden[2,3] and profoundly decreased quality of life.[4,5] In addition to the cutaneous manifestations, psoriasis is associated with a number of significant comorbidities including but not limited to inflammatory arthritis, cardiovascular diseases, and severe depression.[6-8] Psoriasis incurs a substantial economic burden, with recent annual US cost of psoriasis approximating $112 billion.[9] Furthermore,

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Abbreviations used:

BSA: body surface area
DLQI: Dermatology Life Quality Index
NPF: National Psoriasis Foundation
PASI: Psoriasis Area and Severity Index
PGA: Physician Global Assessment

patients with inadequately treated psoriatic disease have significantly reduced work productivity.[4]

Despite the availability of various treatment modalities and continued introduction of more efficacious therapies for psoriasis, nontreatment and undertreatment of patients with psoriasis remain a significant problem in the United States.[3] Over 50% of patients with psoriasis remain dissatisfied with their treatment.[3] Efforts by various organizations to research and advocate for improved management have been hampered by a lack of defined treatment goals for psoriasis in the United States.

CAPSULE SUMMARY

- Establishing treatment goals can help improve patient outcomes.
- The US experts agreed that the target response after initiating new psoriasis treatments should be body surface area 1% or less. The target response at every 6 month maintenance evaluation should be body surface area 1% or less.
- Treatment targets will establish treatment expectations and encourage providers to evaluate progress and adjust treatments.

As the international psoriasis community recognizes the value of defining treatment goals for psoriasis, several consensus efforts have emerged in other parts of the world to define treatment goals.[10,11] According to the European consensus of treatment goals, treatment success is defined as a decrease in Psoriasis Area and Severity Index (PASI) score of 75% or greater that allows for treatment continuation; treatment failure is defined as a decrease in PASI score of less than 50% that necessitates a change in treatment regimen. An intermediate response of decrease in PASI score of 50% or greater but less than 75% with Dermatology Life Quality Index (DLQI) score 5 or less can lead to continuing current regimen, whereas a decrease in PASI score of 50% or greater but less than 75% with DLQI score greater than 5 warrants modifying treatment regimen.[10] In Canada, a treat-to-target consensus defines Physician Global Assessment (PGA) score of 0 (clear) as the measurable target for patients and clinicians.[11] To date, there are no defined treatment targets for psoriasis in the United States.

The rationale for defining treatment goals in the United States is compelling and time-sensitive. Without treatment goals, clinicians and patients have no defined targets during the treatment course, and substantial variability exists in treatment expectation and quality of care. Therefore, determining treatment targets is critical for defining treatment expectations and optimizing psoriasis management in the United States.

The overall purpose of establishing treatment goals in the United States is to improve patient care in psoriasis. Specifically, we aim to establish defined treatment targets toward which both clinicians and patients will strive in order to inform treatment decisions, reduce disease burden, and improve patient outcomes in clinical practice.

METHODS

Overall study design and the Delphi process

To establish treatment targets for psoriasis, we conducted a consensus-building study among the current members of the National Psoriasis Foundation (NPF) Medical Board and other providers with significant clinical and research expertise in psoriatic diseases through the Delphi method. The Delphi had been informed by structured input from patients and general dermatologists. The overall process consisted of 3 steps: (1) literature review; (2) pre-Delphi exercises consisting of Delphi-question selection and discussion, a survey of general dermatologists, and patient focus-group discussions; and (3) the Delphi process consisting of 4 Delphi rounds. This study was approved by the University of Southern California institutional review board (IIR00001886).

Literature review

The goal of the literature review was to examine the existing treatment goals from outside the United States to help guide the initial Delphi-item generation. Literature search was performed for articles published before 2016 pertaining to treatment goals/targets and treatment guidelines in psoriasis. The reason for examining articles on both treatment goals[10-17] and treatment guidelines[18-27] was to determine the range of published outcome measures and cut-off values. The European consensus on defining treatment goals for moderate to severe psoriasis,[10] the Australian treatment goal consensus,[15] and the

Canadian treating to target consensus[11] were particularly informative.

Pre-Delphi exercises

The pre-Delphi exercises consisted of: (1) Delphi question selection and discussion; (2) survey of general, practicing dermatologists; and (3) patient focus-group discussions. First, based on the literature review, we generated candidate-Delphi questions and sought feedback from the Delphi participants via electronic communications, 3 live NPF Medical Board meetings, and 1 additional teleconference.

Second, because the treatment targets are intended to be used in clinical practice, we assessed the current level of familiarity with and use of key measurements (body surface area [BSA], PASI, PGA, PGA×BSA, and DLQI) via a questionnaire distributed to general dermatologists.

Finally, we convened patients with psoriasis with varying psoriasis severity and conducted an in-depth, moderated, semistructured focus-group discussion to ascertain the patients' perspective. Before the focus-group discussion, the patients were informed of its purpose and provided materials to review. Patients expressed that, although BSA in general captured psoriasis disease severity well, factors such as location, symptoms, and quality of life were also important. Patients also reported excessive amount of time spent seeking adequate psoriasis care because of their dissatisfaction with prior treatments, providers, or both. Patients overwhelmingly expressed the desire for complete clearance so long as therapy had a favorable safety profile and was convenient to administer. These findings from the patient focus-group discussion were consistent with clinical trial data.[28]

Delphi process

The Delphi process is a widely accepted form of achieving consensus among a panel of experts. Substantial heterogeneity exists in Delphi methodology in the literature.[29] It is important to note that, in the Delphi process, consensus rarely denotes 100% agreement among the experts; rather, it is the result of a process where the expert participants converge in their opinions after multiple rounds of voting and discussion. In this study, we adhered to the key principles of the Delphi process: anonymity and transparency. In this study, anonymity of individual responses prevented authority, personality, or reputation of some participants from dominating others in the process; this also freed participants of their own personal biases and thereby minimized "bandwagon effect," encouraged self-critique, and facilitated revision of earlier judgments.

Four rounds of Delphi had been determined to be the maximum number of rounds to achieve consensus. These online-based Delphi rounds occurred on November 19, 2015; February 3 and 24, 2016; and March 21, 2016. During each round, the participants answered a structured questionnaire and could provide written comments. After each round, an anonymous summary of the group's input for each question was provided to all participants along with anonymous, verbatim written comments. For subsequent rounds, the participants were asked to re-evaluate their responses in light of the responses of other members.

RESULTS

In all, 25 psoriasis experts consisting of current members of NPF medical board and other psoriasis experts participated in the Delphi process (Tables I and II). Summary of treatment targets from the Delphi consensus is shown in Table III.

Instrument for assessing treatment target

In the pre-Delphi exercise, general dermatologists stated that BSA was the most familiar and used measure in clinical practice (95% familiarity, 78% utilization). DLQI and PGA×BSA were the least familiar (26% and 11%, respectively) and least frequently used (6% and 6%, respectively) measures in clinical practice.

The Delphi participants were asked "In selecting 'targets' for the treat-to-target effort for patients with psoriasis in the United States, which outcomes instrument should be used to measure the target?" The most preferred measure was BSA from the choices of PASI, PGA, BSA, PGA×BSA, and DLQI, in all rounds of Delphi.

Timing for evaluation: Evaluation posttreatment initiation and frequency of evaluation during maintenance phase

When patients initiate a therapy, there is an initial initiation phase, where the therapeutic effects of the intervention begin to take place. This is followed by a maintenance phase, where the therapeutic effect of the intervention reaches a steady state (Fig 1).

Therapies have variable timing for onset of action, and this may not necessarily correlate with a therapy's long-term steady-state effectiveness. We sought to identify a single time point at which the first evaluation after the start of treatment should take place, regardless of therapy. Among the choices of 3 months, 4 months, and 6 months, the most preferred time to perform this initial evaluation was 3 months through all Delphi rounds.

Table I. Instrument selection and treatment-target

	Round 1		Round 2		Round 3	
Choices	Mean (SD)	Median (25th-75th percentile)	Mean (SD)	Median (25th-75th percentile)	Mean (SD)	Median (25th-75th percentile)
Instrument selection for assessing treatment targets						
PASI	2.5 (1.47)	2 (1-4)	2.11 (1.28)	2 (1-3)	2.53 (1.22)	2 (2-3)
PGA	3.5 (1.34)	3.5 (2.25-5)	3 (1.19)	3 (2-4)	3.26 (1.05)	3 (3-4)
BSA, most preferred	4.06 (1.21)	4.5 (3.25-5)	4.22 (1.40)	5 (4-5)	4.53 (0.61)	5 (4-5)
PGA×BSA	3.22 (1.22)	4 (3-4)	3.56 (1.46)	4 (3-5)	3.47 (1.22)	4 (3-4)
DLQI	3.22 (1.17)	3 (3-4)	2.61 (1.20)	2.5 (2-4)	2.68 (1.00)	3 (2-3.5)
Treatment target scores during initial evaluation after starting a therapy						
PASI 75	3.11 (1.60)	3.5 (2-4.75)	2.89 (1.57)	2.5 (2-4.75)	2.79 (1.36)	3 (1.5-4)
PASI 90	3.06 (1.47)	3.5 (2-4)	3.00 (1.46)	3 (2-4)	3.00 (1.37)	4 (1.5-4)
PASI 100	2.89 (1.45)	3 (2-4)	3.06 (1.59)	3 (2-5)	2.74 (1.41)	3 (1.5-4)
PASI = 0	2.88 (1.36)	3 (2-4)	2.44 (1.46)	2 (1-3)	2.63 (1.38)	2 (1.5-4)
PASI ≤1	2.61 (1.29)	2.5 (1.25-4)	2.39 (1.29)	2 (1.25-3.75)	2.37 (1.16)	2 (1-3)
PASI ≤3	2.50 (1.29)	2 (1.25-3.75)	2.06 (0.94)	2 (1.25-2)	2.26 (1.05)	2 (1-3)
PASI ≤5	2.22 (1.11)	2 (1-3)	1.89 (0.90)	2 (1-2)	2.00 (0.88)	2 (1-3)
PGA = 0, clear	3.39 (1.24)	3.5 (2.25-4)	2.83 (1.20)	3 (2-3.75)	2.89 (1.24)	3 (2-4)
PGA ≤1, clear or almost clear	4.00 (1.19)	4 (3.25-5)	4.00 (1.08)	4 (4-5)	4.26 (0.87)	4 (4-5)
BSA = 0%	3.28 (1.07)	3 (3-4)	3.06 (1.35)	3 (2-4)	3.00 (1.37)	3 (2-4)
BSA ≤1%, most preferred	3.35 (1.37)	4 (2-4)	3.94 (1.11)	4 (4-5)	4.42 (0.77)	5 (4-5)
BSA ≤3%	2.94 (1.11)	3 (2-4)	2.61 (1.14)	2.5 (2-3)	2.84 (1.26)	3 (2-3.5)
BSA ≤5%	2.56 (1.29)	2.5 (1.25-3.75)	1.94 (0.80)	2 (1-2.75)	2.16 (1.07)	2 (1-3)
PGA×BSA = 0	2.71 (1.36)	3 (2-4)	2.72 (1.53)	2.5 (1.25-3.75)	2.42 (1.26)	2 (1.5-3.5)
PGA×BSA ≤1	3.06 (1.39)	3 (2-4)	3.22 (1.26)	3.5 (3-4)	3.00 (1.20)	3 (2-4)
PGA×BSA ≤3	2.67 (1.33)	2.5 (2-3.75)	2.67 (1.28)	3 (1.25-3.75)	2.68 (1.20)	3 (2-3.5)
PGA×BSA ≤5	2.28 (1.32)	2 (1-3)	2.11 (1.18)	2 (1-3)	2.00 (0.88)	2 (1-2.5)
DLQI = 0	2.89 (1.32)	3 (2-4)	2.50 (1.29)	2.5 (1.25-3)	2.37 (1.34)	2 (1-3.5)
DLQI ≤1	3.17 (1.50)	3.5 (2-4)	3.61 (1.33)	4 (3-4.75)	2.74 (1.33)	3 (1.5-4)
DLQI ≤5	2.78 (1.35)	3 (2-4)	2.06 (1.00)	2 (1-3)	2.42 (1.26)	2 (1-3)
Treatment target scores during the maintenance phase						
PASI = 0	2.89 (1.45)	3 (2-4)	2.89 (1.57)	2.5 (2-4.75)	2.68 (1.49)	2 (1.5-4)
PASI ≤1	2.83 (1.42)	3.5 (1.25-4)	2.83 (1.38)	3 (2-4)	2.47 (1.31)	2 (1-3.5)
PASI ≤3	2.67 (1.53)	2.5 (1-4)	2.22 (1.17)	2 (1-3)	2.21 (1.03)	2 (1-3)
PASI ≤5	2.22 (1.17)	2 (1-3)	1.72 (0.83)	2 (1-2)	1.84 (0.83)	2 (1-2.5)
PGA = 0	3.28 (1.36)	3.5 (2-4)	2.94 (1.51)	3 (2-4)	2.84 (1.34)	3 (2-4)
PGA ≤1	3.94 (1.35)	4 (4-5)	4.28 (0.96)	4 (4-5)	4.37 (0.96)	5 (4-5)
BSA 0%	3.17 (1.29)	3 (2-4)	2.94 (1.51)	3 (2-4)	2.95 (1.39)	3 (2-4)
BSA ≤1%, most preferred	3.44 (1.34)	4 (2.25-4)	4.22 (1.00)	4 (4-5)	4.42 (0.84)	5 (4-5)
BSA ≤3%	2.83 (1.10)	3 (2-4)	2.50 (1.25)	2.5 (1.25-3)	2.74 (1.15)	3 (2-3.5)
BSA ≤5%	2.47 (1.18)	2 (2-3)	1.72 (0.89)	1.5 (1-2)	1.95 (0.91)	2 (1-2.5)
PGA×BSA = 0	2.83 (1.38)	3 (2-4)	2.50 (1.42)	2.5 (1-3)	2.47 (1.47)	2 (1-3.5)
PGA×BSA ≤1	3.06 (1.47)	3 (2-4)	3.00 (1.19)	3 (2.25-4)	2.95 (1.13)	3 (2-4)
PGA×BSA ≤3	2.72 (1.27)	3 (2-4)	2.67 (1.24)	3 (1.25-4)	2.58 (1.22)	2 (2-3.5)
PGA×BSA ≤5	2.33 (1.28)	2 (1-3)	2.00 (1.08)	2 (1-2.75)	1.89 (0.88)	2 (1-2)
DLQI = 0	3.00 (1.46)	3 (2-4)	2.78 (1.40)	3 (2-3.75)	2.32 (1.34)	2 (1-3)
DLQI ≤1	3.28 (1.45)	4 (2-4)	3.67 (1.41)	4 (2.5-5)	2.68 (1.45)	2 (1.5-4)
DLQI ≤5	2.67 (1.33)	3 (2-3)	2.06 (0.87)	2 (1.25-2.75)	2.26 (1.15)	2 (1-3)

Agreement scores 1-5, where 1 = strongly disagree and 5 = strongly agree, from Delphi rounds 1 through 3.
BSA, Body surface area; *DLQI*, Dermatology Life Quality Index; *PASI*, Psoriasis Area and Severity Index; *PGA*, Physician Global Assessment.

Table II. Acceptable versus target body surface area responses 3 months postinitiation

Instrument choices	Mean (±SD)	Median (25th-75th percentile)
Acceptable BSA 3 mo after treatment initiation, static measure		
BSA ≤5%	3.28 (1.34)	4 (3.75-4.25)
BSA ≤3%, most preferred	3.64 (1.22)	4 (4-5)
BSA ≤1%	3.20 (1.41)	3 (2.75-4.25)
Acceptable BSA improvement from baseline at 3 mo posttreatment initiation, dynamic measure		
≥50% BSA improvement	3.12 (1.36)	3.5 (2-4)
≥75% BSA improvement, most preferred	3.84 (1.14)	4 (4-5)
≥90% BSA improvement	3.60 (1.32)	4 (3-4.25)
Target BSA response 3 mo after treatment initiation, static		
BSA ≤5%	2.80 (1.12)	3 (2-3.25)
BSA ≤3%	3.88 (1.01)	4 (4-5)
BSA ≤1%, most preferred	3.92 (1.26)	4 (3.75-5)

Agreement scores 1-5, where 1 = strongly disagree and 5 = strongly agree, from Delphi round 4.
BSA, Body surface area.

To determine the frequency with which treatments should be evaluated during the maintenance phase, the participants were asked to choose among frequencies of every 3 months, 6 months, and 1 year. The participants preferred evaluation every 6 months during the maintenance phase in all Delphi rounds.

Acceptable versus target responses posttreatment initiation

We asked the participants to indicate their preferred level of acceptable versus target treatment responses for each proposed instrument/measure at 3 months posttreatment initiation (Table II). An acceptable response was what the participants would consider as an adequate or sufficient level of response to treatment. In comparison, a target response was a goal toward which clinicians and patients could strive.

By the final round of Delphi, for evaluation of treatment response at 3 months posttreatment initiation, the participants indicated either BSA 3% or less or BSA improvement 75% or greater from baseline as an acceptable response; they indicated BSA 1% or less as the target response. For the every 6-month evaluation during the maintenance therapy, BSA 1% or less was again selected as the target response.

Fulfillment of a single criterion versus multiple criteria

Treatment goals outside of the United States have included the simultaneous fulfillment of multiple measures to determine treatment success or failure. For example, European goals defined treatment success as achieving both at least 75% improvement in PASI score and a DLQI score of 5 or less.

For the US Delphi process, the participants were asked if they preferred the use of a single criterion or multiple criteria to determine treatment success. The advantage of using a single criterion is ease of use in clinical practice; the disadvantage is that the criterion may not encompass other important aspects of the disease burden. In comparison, the advantage of using multiple criteria is the ability to capture multiple aspects of the disease burden; the disadvantage relates to the increased administrative burden and

Table III. Summary of treatment targets from the Delphi consensus

Preferred assessment instrument in clinical practice	BSA
Acceptable response after treatment initiation	Either BSA ≤3% or BSA improvement ≥75% from baseline at 3 mo after treatment initiation
Target response after treatment initiation	BSA ≤1% at 3 mo after treatment initiation
Target response during maintenance therapy	BSA ≤1% at every 6 mo assessment intervals during maintenance therapy

Treatment targets apply to plaque psoriasis, and they are to be discussed in the context of individualized evaluation of benefit-risk assessment and elicitation of patient preferences. They are not to be used to deny access to therapies.
BSA, Body surface area.

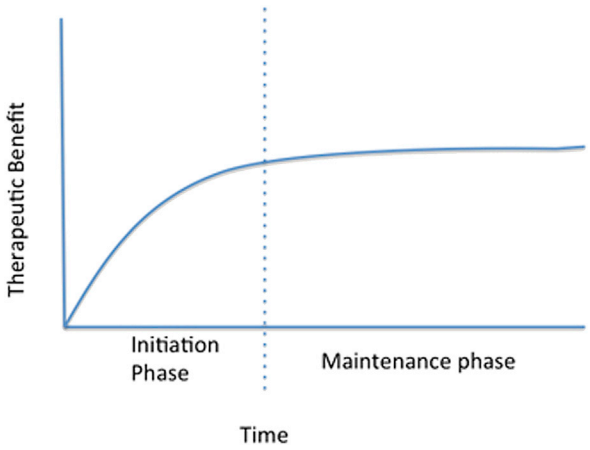

Fig 1. Psoriasis. Therapeutic benefit during initiation and maintenance phases.

reduced feasibility in clinical practice. From all Delphi rounds, the most preferred response was the fulfillment of a single criterion to achieve treatment goals.

Key summary of treatment targets

The Delphi consensus-building process generated the following findings (Table III). The most preferred acceptable response to treatment at 3 months after treatment initiation is either BSA 3% or less or BSA improvement 75% or greater from baseline; the target response to treatment at 3 months after treatment initiation is BSA 1% or less; and the target response during the every 6-month maintenance evaluation is BSA 1% or less.

DISCUSSION

Establishing treatment goals and then treating-to-target are evidence-based practices that have been implemented with positive patient outcomes in many disease areas such as diabetes, hypertension, and rheumatoid arthritis.[30-32] Although treat-to-target efforts have been developed in other parts of the world for psoriasis, to our knowledge, no such organized, consensus-building effort has occurred in the United States until now. From the perspective of many stakeholders in psoriasis care including patients, clinicians, researchers, payers, and health policy experts, an urgent need exists in the United States to establish treatment expectations and improve patient outcomes in clinical practice.

This consensus-seeking effort to establish treatment targets in psoriasis has been a pivotal, iterative endeavor organized by the NPF and conducted by a panel of psoriasis experts. The expressed aim of this treat-to-target effort was to establish treatment expectations and augment the overall quality of care for patients with psoriasis in clinical settings. With the defined treatment targets, both clinicians and patients can strive to adequately monitor disease progression and evaluate patient responses to treatments in clinical practice.

Based on the discussion of the psoriasis experts, below are ways in which the treatment targets can be applied in clinical practice. The treatment targets are goals toward which the clinicians and patients can strive during the course of psoriasis management. At this time, these targets provide guidance on what to strive toward but not how to achieve these goals. This is because the exact treatment decisions will depend on a thorough benefit-risk assessment of the patient by the clinician; this assessment needs to account for the heterogeneity in patient demographics, clinical presentation, comorbidities, access to medical care, and treatment preferences.

Specifically, in clinical practice, the clinician and the patient can use these treatment targets to monitor disease progression and evaluate patient response to treatment. If treatment goals are met at defined time intervals, the patient's disease state is thought to have satisfied the current, established US treatment targets for plaque psoriasis.

If the treatment goals are not met at defined time intervals, this provides opportunities for the clinician and patient to re-evaluate the disease state and the existing treatment regimen. Not meeting the treatment target should prompt discussions between the provider and the patient about treatment options based on benefit-risk assessment. These discussions need to account for the multitude of clinical, socioeconomic, and behavioral factors that influence treatment outcomes and may necessitate treatment re-evaluations. The clinicians and patients should discuss all relevant treatment options in order to maximize the likelihood of meeting treatment targets; the management options may include but are not limited to treatment escalation with the same treatment, combination therapies with other agents, or switching treatments. These discussions also need to take into account a continual assessment of patient satisfaction.

Importantly, we recognize that a real-world challenge to implementing these treatment goals is the limited access to some therapies. Thus, we advocate for increasing access to treatments such that providers and patients have the greatest number of therapeutic options to achieve these goals. Specifically, the payers should not apply these established treatment targets to deny access to existing therapies even if the patients have not met the target; rather, payers should consider increasing the accessibility of other therapeutic options, including treatment escalation or combinations, to help patients achieve treatment targets.

Over time, these targets will likely need to be adjusted to account for improvements in instruments to accurately capture psoriasis burden and to increase feasibility in clinical practice. For now, BSA was identified as the most practical instrument for use by general dermatologists and the most appropriate instrument by experts. However, patients communicated that BSA does not capture location, symptoms, comorbidities, or life quality. Thus, we encourage the development and validation of instruments, including patient-reported measures, which are reliable, discriminating, and feasible to administer in clinical settings.

In summary, the establishment of treatment targets is a critical, time-sensitive endeavor in the United States that aims to establish expectations

and improve quality of care for patients with psoriasis. Despite methodological heterogeneity across various disciplines in the Delphi consensus-building approach, the psoriasis experts in this Delphi process converged in their assessment of treatment targets. The treatment targets derived from this endeavor are not only highly clinically relevant and feasible to assess in practice but are also affirming to patients' expectations for disease clearance. These treatment targets enable the providers and patients to regularly reflect upon treatment progress and seek ways to decrease disease burden. Efforts to create valid, feasible, and clinically relevant measures in psoriasis will positively impact future treat-to-target endeavors. Finally, future research should focus on how to make evidence-based therapeutic modifications to achieve these treatment targets, how to increase patient access to therapies, and how implementation of treatment targets in the real world impacts patient outcomes.

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REFERENCES

1. Rachakonda TD, Schupp CW, Armstrong AW. Psoriasis prevalence among adults in the United States. *J Am Acad Dermatol*. 2014;70(3):512-516.
2. Lebwohl MG, Kavanaugh A, Armstrong AW, Van Voorhees AS. US perspectives in the management of psoriasis and psoriatic arthritis: patient and physician results from the population-based Multinational Assessment of Psoriasis and Psoriatic Arthritis (MAPP) survey. *Am J Clin Dermatol*. 2016;17(1):87-97.
3. Armstrong AW, Robertson AD, Wu J, Schupp C, Lebwohl MG. Undertreatment, treatment trends, and treatment dissatisfaction among patients with psoriasis and psoriatic arthritis in the United States: findings from the National Psoriasis Foundation surveys, 2003-2011. *JAMA Dermatol*. 2013;149(10):1180-1185.
4. Armstrong AW, Schupp C, Wu J, Bebo B. Quality of life and work productivity impairment among psoriasis patients: findings from the National Psoriasis Foundation survey data 2003-2011. *PLoS One*. 2012;7(12):e52935.
5. Rapp SR, Feldman SR, Exum ML, Fleischer AB Jr, Reboussin DM. Psoriasis causes as much disability as other major medical diseases. *J Am Acad Dermatol*. 1999;41(3 Pt 1):401-407.
6. Kurd SK, Troxel AB, Crits-Christoph P, Gelfand JM. The risk of depression, anxiety, and suicidality in patients with psoriasis: a population-based cohort study. *Arch Dermatol*. 2010;146(8):891-895.
7. Yeung H, Takeshita J, Mehta NN, et al. Psoriasis severity and the prevalence of major medical comorbidity: a population-based study. *JAMA Dermatol*. 2013;149(10):1173-1179.
8. Armstrong EJ, Harskamp CT, Armstrong AW. Psoriasis and major adverse cardiovascular events: a systematic review and meta-analysis of observational studies. *J Am Heart Assoc*. 2013;2(2):e000062.
9. Brezinski EA, Dhillon JS, Armstrong AW. Economic burden of psoriasis in the United States: a systematic review. *JAMA Dermatol*. 2015;151(6):651-658.
10. Mrowietz U, Kragballe K, Reich K, et al. Definition of treatment goals for moderate to severe psoriasis: a European consensus. *Arch Dermatol Res*. 2011;303(1):1-10.
11. Gulliver W, Lynde C, Dutz JP, et al. Think beyond the skin: 2014 Canadian expert opinion paper on treating to target in plaque psoriasis. *J Cutan Med Surg*. 2015;19(1):22-27.
12. Mrowietz U, Kragballe K, Nast A, Reich K. Strategies for improving the quality of care in psoriasis with the use of treatment goals—a report on an implementation meeting. *J Eur Acad Dermatol Venereol*. 2011;(25 Suppl 3):1-13.
13. Mrowietz U. Implementing treatment goals for successful long-term management of psoriasis. *J Eur Acad Dermatol Venereol*. 2012;(26 Suppl 2):12-20.
14. Puig L. PASI90 response: the new standard in therapeutic efficacy for psoriasis. *J Eur Acad Dermatol Venereol*. 2015;29(4):645-648.
15. Baker C, Mack A, Cooper A, et al. Treatment goals for moderate to severe psoriasis: an Australian consensus. *Australas J Dermatol*. 2013;54(2):148-154.
16. Schoels MM, Braun J, Dougados M, et al. Treating axial and peripheral spondyloarthritis, including psoriatic arthritis, to target: results of a systematic literature search to support an international treat-to-target recommendation in spondyloarthritis. *Ann Rheum Dis*. 2014;73(1):238-242.
17. Manalo IF, Gilbert KE, Wu JJ. Time to raise the bar to Psoriasis Area Severity Index 90 and 100. *J Drugs Dermatol*. 2015;14(10):1086-1088.
18. Nast A, Boehncke WH, Mrowietz U, et al. S3-Guidelines on the treatment of psoriasis vulgaris (English version). Update. *J Dtsch Dermatol Ges*. 2012;(10 Suppl 2):S1-S95.
19. Pathirana D, Ormerod AD, Saiag P, et al. European S3-guidelines on the systemic treatment of psoriasis vulgaris. *J Eur Acad Dermatol Venereol*. 2009;(23 Suppl 2):1-70.
20. Menter A, Korman NJ, Elmets CA, et al. Guidelines of care for the management of psoriasis and psoriatic arthritis: section 6. Guidelines of care for the treatment of psoriasis and psoriatic arthritis: case-based presentations and evidence-based conclusions. *J Am Acad Dermatol*. 2011;65(1):137-174.
21. Daudén E, Puig L, Ferrándiz C, Sánchez-Carazo JL, Hernanz-Hermosa JM, Spanish Psoriasis Group of the Spanish Academy of Dermatology and Venereology. Consensus document on the evaluation and treatment of moderate-to-severe psoriasis: Psoriasis Group of the Spanish Academy of Dermatology and Venereology. *J Eur Acad Dermatol Venereol*. 2016;(30 Suppl 2):1-18.
22. Hsu S, Papp KA, Lebwohl MG, et al. Consensus guidelines for the management of plaque psoriasis. *Arch Dermatol*. 2012;148(1):95-102.
23. Kragballe K, Gniadecki R, Mørk NJ, Rantanen T, Ståhle M. Implementing best practice in psoriasis: a Nordic expert group consensus. *Acta Derm Venereol*. 2014;94(5):547-552.
24. Langley RG, Saurat JH, Reich K; Nail Psoriasis Delphi Expert Panel. Recommendations for the treatment of nail psoriasis in patients with moderate to severe psoriasis: a dermatology expert group consensus. *J Eur Acad Dermatol Venereol*. 2012;26(3):373-381.
25. Papp K, Gulliver W, Lynde C, Poulin Y, Ashkenas J; Canadian Psoriasis Guidelines Committee. Canadian guidelines for the management of plaque psoriasis: overview. *J Cutan Med Surg*. 2011;15(4):210-219.
26. Puig L, Bordas X, Carrascosa JM, et al. Consensus document on the evaluation and treatment of moderate-to-severe psoriasis. Spanish psoriasis group of the Spanish Academy of Dermatology and Venereology [in Spanish]. *Actas Dermosifiliogr*. 2009;100(4):277-286.

27. Paul C, Gourraud PA, Bronsard V, et al. Evidence-based recommendations to assess psoriasis severity: systematic literature review and expert opinion of a panel of dermatologists. *J Eur Acad Dermatol Venereol*. 2010;(24 Suppl 2):2-9.
28. Strober B, Papp KA, Lebwohl M, et al. Clinical meaningfulness of complete skin clearance in psoriasis. *J Am Acad Dermatol*. 2016;75:77-82.e7.
29. Lindstone HA. *The Delphi Method: Techniques and Applications*. Reading (MA): Addison-Wesley; 1975
30. Smolen JS, Aletaha D, Bijlsma JW, et al. Treating rheumatoid arthritis to target: recommendations of an international task force. *Ann Rheum Dis*. 2010;69(4):631-637.
31. Wangnoo SK, Sethi B, Sahay RK, John M, Ghosal S, Sharma SK. Treat-to-target trials in diabetes. *Indian J Endocrinol Metab*. 2014;18(2):166-174.
32. Sitbon O, Galie N. Treat-to-target strategies in pulmonary arterial hypertension: the importance of using multiple goals. *Eur Respir Rev*. 2010;19(118):272-278.